

REMARKS

Claims 1-14 remain in the application.

The present invention removes color drifts in an image by smoothing out the luminance of the composite image while at the same time preventing the image quality from being deteriorated by reducing the accumulation of smooth-out effects. (Pg. 3, lns. 15-21). As shown in Figures 18, in S31, the color value storage unit 51 stores the color values and the transparency value or α value of the target sub-pixels and four adjacent sub-pixels in the front image received from the texture mapping unit 33. (Pg. 54, lns. 15-17). Thus, the color value storage unit 51 stores color values and α values of five sub-pixels comprising the target sub-pixel and the four sub-pixels adjacent the target sub-pixel. (Pg. 54, lns. 17-22). In S32, the dissimilarity level is calculated on a target sub-pixel and four sub-pixels adjacent the target sub-pixel. The color space distance calculating unit 52 calculates the Euclidean square distance in a color space including α values for each combination of the five sub-pixels identified whose values are stored in the color value storage unit 51. The largest color space distance selecting unit 54 selects the largest value amongst the Euclidean square distance values output from the color space distance calculating unit 52 and outputs the selected value to the filtering coefficient interpolating unit 75. (Pg. 54, ln. 23 – Pg. 55, ln. 4).

In S33, the filtering coefficient interpolating unit 75 determines a filtering coefficient for the target sub-pixel by performing a calculation on the initial values stored in the initial filtering coefficient storage unit 75 in accordance with the dissimilarity level received from the largest color space distance selecting unit 53 and outputs the determined filtering coefficient to a luminance filtering unit 66 of the filtering unit 50. (Pg. 55, lns. 4-11).

In S34, the superimposing unit 41 calculates a color value of the corresponding target sub-pixel in the composite image from the color values of the front image output from the texture mapping unit 33 and the color values of the back image output from the back-image tripling unit 34. (Pg. 55, lns. 12-19).

In S35, the color space conversion unit 61 receives the color value of the corresponding target sub-pixel in the composite image and converts the color values of the R-G-B color space into the values of luminance, blue-color-difference, and red-color-difference of the Y-Cb-Cr color space. The luminance values are outputted to the luminance filtering unit 66 while the blue-color difference value and the red-color-difference value is outputted to the RGB mapping unit 65. (Pg. 55, lns. 20-26).

In S36, the luminance filtering unit 66 stores the luminance values received from the color space conversion unit 61 into the buffer. In S37, the luminance filtering unit 66 calculates the luminance value of the target sub-pixel by performing a filtering process in accordance with the filtering coefficient received from the filtering coefficient interpolating unit 75 and outputs the post-filtering luminance values of the target sub-pixel to the RGB mapping unit 65. (Pg. 55, ln. 17 – Pg. 56, ln. 12).

In summary, a calculation unit calculates the dissimilarity level of first-target-range sub-pixels in a front image. A superimposing unit then generates a composite image from the front image and an “image currently displayed on the display device.” The “image currently displayed on the display device” is the back image. (See Spec. pg. 43, lns. 4-9). The filtering unit then smoothes out the second-target-range sub-pixels of the composite image which correspond to the first-target range sub-pixels of the front image by assigning weights, which are determined in accordance with the dissimilarity of the first-target-range sub-pixels. This is advantageous

because it reduces the amount of filtering done to the “image currently displayed on the display device” or back image and thus reduces the degradation of the “image currently displayed on the display device.”

The Office Action rejected Claims 1-12 under 35 U.S.C. § 103(a) as being unpatentable over *Betrissey et al.* (U.S. 6,738,526, hereinafter “*Betrissey*”) in view of *Hill et al.* (U.S. 6,577,291, hereinafter “*Hill*”).

Betrissey is directed towards solving the problem of displaying small sized text on LCDs by filtering the glyphs. In the first embodiment using post-cache filtering, the glyph display routine 824 has available the intermediate alpha values of the glyphs. To get the intermediate alpha values for the glyph, the glyph is sampled six times per pixel, or two times per sub-pixel as seen in Figures 9 and 10. The two values for each sub-pixel are then summed up to produce the intermediate alpha value for each sub-pixel in the glyph. Thus, the glyphs are represented by these intermediate alpha values which are concatenated prior to filtering. Therefore, by the time the filtering is performed, the intermediate alpha values located adjacent to glyph boundaries are defined and available for use during the filtering process. This prevents color leakage across glyph boundaries. During the filtering process, the preceding and subsequent intermediate alpha value for each sub-pixel is added to the intermediate alpha value for the sub-pixel to produce the filtered alpha values.

In the second embodiment using pre-cache filtering, the filter routine 813 first samples the glyph 6 times per pixel, or 2 times per sub-pixel as seen in Figure 14. The 2 values for each sub-pixel are then summed up to produce the intermediate alpha value for each sub-pixel in the glyph. The glyph is then analyzed to determine if padding is necessary. The glyph is padded to add background alpha values along each pixel edge where color leakage will occur outside of the

glyph as seen in Figure 15. Then each character glyph is filtered. During the filtering process, the preceding and subsequent intermediate alpha value for each sub-pixel is added to the intermediate alpha value for the sub-pixel to produce the filtered alpha values. Then the individual character glyphs are combined. Since some character glyphs may be padded, pixel overlaps may occur. In the case of a character glyph overlap, the three alpha values of the overlapping pixel from each character glyph are summed together to produce three new alpha values for the overlapping pixel.

The Office Action admits that *Betrisey* does not teach or suggest “a calculation unit operable to calculate a dissimilarity level of a target sub-pixel to one or more sub-pixels that are adjacent to the target sub-pixel in the lengthwise direction of the pixel rows, from color values of first-target-range sub-pixels composed of the target sub-pixel and the one or more adjacent sub-pixels stored in the front image storage unit.”

The Office Action also admits that *Betrisey* does not disclose “a filtering unit operable to smooth out color values of second-target-range sub-pixels of the composite image that correspond to the first-target-range sub-pixels, by assigning weights, which are determined in accordance with the dissimilarity level, to the second-target-range sub-pixels.”

Betrisey also does not recite “a displaying unit operable to display the composite image based on the color values thereof after the smoothing out.” Since *Betrisey* does not smooth out the composite image through the filtering unit, it does not display a smoothed out composite image.

Hill solves the problem of aliasing associated with displaying relatively low resolution representations of text by exploiting the different intensity contributions by the red pixel, the

green pixel, and the blue pixel to the human eye through a weighted scan conversion. (Col. 4, lns. 40-60; Col. 17, ln. 29 – Col. 18, ln. 5).

However, after this weighted scan conversion is completed, the pixel color processing sub-routine 970 in Figure 9C or sub-routine 990 in 9D are used to determine if the luminous intensity values of the CURRENT PIXEL should be adjusted to reduce or eliminate color artifacts and to make such adjustments as required. (Col. 20 lns. 40-45). In sub-routine 970 displayed in Figure 9C, only the CURRENT PIXEL is analyzed, independent of any other pixels in the foreground or background. (Col. 21, lns 16-18). In sub-routine 990 displayed on Figure 9D, the CURRENT PIXEL is compared with the pixel in the front image and the back image. If the difference is greater than a pre-selected acceptable range, the color of the CURRENT PIXEL is adjusted towards the range of acceptable colors. This may involve modifying one or more of the red, blue, or green sub-pixels.

Hill does not does not disclose “a filtering unit operable to smooth out color values of second-target-range sub-pixels of the composite image that correspond to the first-target-range sub-pixels, by assigning weights, which are determined in accordance with the dissimilarity level, to the second-target-range sub-pixels.” In sub-routine 970 in *Hill*, the luminance intensity value of the red pixel and green pixel of a single pixel are compared with each other. If the luminance intensity values of the red pixel and the green pixel differ above an acceptable value, the single pixel containing the red pixel and the green pixel is then modified. *Hill* does not modify a different pixel such as a pixel in a composite image nor does it modify a different pixel based on a dissimilarity from the target pixel.

In contrast, the present invention calculates the dissimilarity level based on the target sub-pixel and its adjacent sub-pixel in the front image. (Pg. 54, ln. 23 – Pg. 55, ln. 4). It then

calculates a filtering coefficient based on the dissimilarity level of the target sub-pixel and its adjacent sub-pixel in the front image to filter the target sub-pixel corresponding to composite image. (Pg. 55, lns. 4-11; lns. 20-26; Pg. 56, lns. 1-12).

Hill also does not recite “a displaying unit operable to display the composite image based on the color values thereof after the smoothing out.” Since *Hill* does not smooth out the composite image through the filtering unit, it does not display a smoothed out composite image.

Furthermore, even if *Hill* and *Betrisey* were combined, and there is no indication that they should be combined, the hypothetical combination would still not produce the present invention. Even if *Hill* were used for its filtering process, there is no indication in *Betrisey* or *Hill* that the dissimilarity level should be taken from the front image and the changes be done on the composite image to prevent image degradation. In *Betrisey*, the foreground and background color is applied to the filtered alpha values using color blending techniques, and gamma correction is performed. The resulting gamma corrected R, G, and B luminous intensity values are stored in the display buffer for use in controlling the output of the display device 754. (Col. 17, lns. 60-65). The alpha values that are filtered do not pertain to the background or foreground image, but instead represent the transparency of the background and foreground image. Furthermore, the gamma correction suggested by *Betrisey* is a general process performed onto the composite image in order to conform the image with the characteristics of the display device. This adjustment could negatively impact the image quality of the composite image since any adjustments to the composite image could degrade the image quality of the composite image. There is nothing in *Betrisey* to suggest that some calculation should be done onto the front image, before performing the gamma correction on the composite image to reduce the image degradation. In *Hill*, the same pixel is analyzed and modified and there is no indication that a

pixel from a front image should be analyzed and a pixel from a composite image should be modified. Thus, even if *Hill* and *Betrissey* were combined, the hypothetical combination would determine the difference in intensity value of the pixel sub-components in the composite image and adjust the luminous intensity between pixel sub-components with respect to the same composite image.

In contrast, the present invention would determine the dissimilarity level from the target pixel range in the front image and modify the target pixel in the composite image based on the dissimilarity level from the target pixel range in the front image.

With respect to Claim 5, all arguments for patentability with respect to claim 1 are repeated and incorporated herein.

Furthermore, in Claim 5, *Betrissey* and *Hill* do not disclose “a calculation unit operable to calculate a dissimilarity level of a target sub-pixel to one or more sub-pixels that are adjacent to the target sub-pixel in the lengthwise direction of the pixel rows, from (i) color values and (ii) transparency values of first-target-range sub-pixels composed of the target sub-pixel and the one or more adjacent sub-pixels stored in the front image storage unit.” Although *Betrissey* may disclose a transparency value, neither *Betrissey* nor *Hill* teaches that the transparency value should be used to calculate the dissimilarity level. *Betrissey* only teaches applying foreground/background color to the filtered alpha values using color blending techniques and then performing gamma correction. (Col. 17, lns. 60-64). There is no indication in *Betrissey* that the alpha value should be used to calculate the dissimilarity level. Furthermore, *Hill* only teaches utilizing the color values and does not teach using the transparency values in addition to the color value when comparing two sub-pixels.

In contrast, in the present invention, both the color values and the transparency values are used to calculate the dissimilarity level in the target sub-pixels in the front image. (Pg. 27, ln. 22 – Pg. 28, ln. 22). This is advantageous because it takes into account the transparency values which may cause color drifts to be observed by the user. This allows color drifts which may not be visible when only the front image is viewed, but which are visible in the composite image due to the difference in transparency between sub-pixels of the front image. Furthermore, this is also advantageous because it reduces degradation of the composite image which corresponds to the back image by preventing those portions of the composite image corresponding to the back image to be filtered, since the back image has already been filtered.

With respect to Claim 2, neither *Betrisey* nor *Hill* discloses “the calculation unit calculates a temporary dissimilarity level for each combination of the first-target-range sub-pixels, from color values of the first-target-range sub-pixels, and regards a largest temporary dissimilarity level among results of the calculation to be the dissimilarity level.” The Office Action cites to flow chart in 9C. However chart 9C only discloses that if the differential between the luminance intensity of the red pixel and the luminance intensity of the green pixel is above a threshold value, that the red pixel and the green pixel should be modified. Thus, it calculates a single differential for each target sub-pixel. It does not determine the largest temporary dissimilarity level for each combination of the first-target-range sub-pixels since it only compares two sub-pixels and thus only has a single differential.

The arguments for patentability with respect to Claim 1 are repeated and incorporated herein for Claims 9 and 11. The arguments for patentability with respect to Claim 5 are repeated and incorporated herein for Claims 10 and 12.

The Office Action rejected Claim 13 under *Betrisey* in view of *Hill* and *Ohta et al.* (U.S. Pub. 2003/0090494, hereinafter "*Ohta*").

The arguments for patentability with respect to Claim 1 is repeated and incorporated herein for Claim 13 while the arguments for patentability with respect to Claim 5 is repeated and incorporated herein for Claim 14.

Claims 2-4 and 6-8 depend from and further define Claims 1 and 5 and are patentable for at least the reasons given.

The application now only contains allowable subject matter, and accordingly, it is believed it is in condition for allowance. If there are any questions with regards to this response, the undersigned attorney can be contacted at the listed phone number.

Very truly yours,

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